Problem 3.47: Pre-emphasis or De-emphasis?

In audio applications, prior to analog-to-digital conversion signals are passed through what is known as a **pre-emphasis circuit** that leaves the low frequencies alone but provides increasing gain at increasingly higher frequencies beyond some frequency f_0. **De-emphasis circuits** do the opposite and are applied after digital-to-analog conversion. After pre-emphasis, digitization, conversion back to analog and de-emphasis, the signal's spectrum should be what it was.

The op-amp circuit here (Figure 3.88) has been designed for pre-emphasis or de-emphasis (Samantha can't recall which).

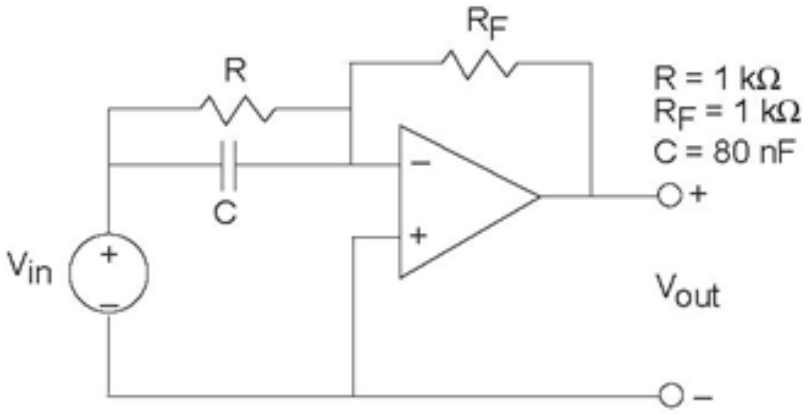

Figure 3.88 Pre-emphasis or De-emphasis?

1. Is this a pre-emphasis or de-emphasis circuit? Find the frequency fo that defines the transition from low to high frequencies.
2. What is the circuit's output when the input voltage is $\sin(2\pi ft)$, with $f = 4kHz$?
3. What circuit could perform the opposite function to your answer for the first part?